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Quality Assurance and Quality Control Plan for the NAPAP (National Acid Precipitation Assessment Program) 1985 Emission Inventory

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Quality Assurance and Quality Control Plan for the NAPAP 1985 Emission Inventory

by

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16. ABSTRACT The report identifies quality assurance (QA) and quality control (QC) objectives that must be met to create an accurate and comprehensive inventory of 1985 emissions from anthropogenic sources thought to be important in acid deposition processes. Most of the 1985 emissions inventory data for this inventory are being collected and analyzed by state air pollution control agencies and the U.S. EPA. The report reviews data quality objectives, priorities, and constraints for the collection of the 1985 inventory data. The responsibilities of the inventory participants are delineated and presented chronologically in a workplan. QA and QC checks of both inventory data and the allocation factors used to resolve the data spatially, temporally, and by pollutant species are discussed. Guidelines for data processing, documentation, and the calculation of data quality indicators are reviewed. The National Acid Precipitation Assessment Program (NAPAP) was established by Congress in 1980 to coordinate and expand research on problems posed by acid deposition in and around the U.S. One fundamental objective of NAPAP's research program is the location and quantification of natural and anthropogenic emissions that may contribute to acid deposition.

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Quality Control	Stationary Sources	13H,14D 04B
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Emission	Anthropogenesis	14G
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ABSTRACT

The National Acid Precipitation Assessment Program (NAPAP) was established by Congress in 1980 to coordinate and expand research on problems posed by acid deposition in and around the United States. One fundamental objective of NAPAP's research program is the location and quantification of natural and anthropogenic emissions that may contribute to acid deposition. To achieve this objective, NAPAP's Task Group on Emissions and Controls is conducting a multi-year research effort to develop an accurate and comprehensive inventory of 1985 emissions from sources thought to be important in acid deposition processes. Most of the 1985 emissions inventory data for this inventory are being collected and analyzed by State air pollution control agencies and the United States Environmental Protection Agency. This report has been developed to identify quality assurance and quality control objectives that must be met to create a comprehensive and accurate inventory. The report reviews data quality objectives, priorities, and constraints for the collection of the 1985 inventory data. The responsibilities of the inventory participants are delineated and presented chronologically in a workplan. Quality assurance and quality control checks of both inventory data and the allocation factors used to resolve these data spatially, temporally, and by pollutant species are discussed. Guidelines for data processing, documentation, and the calculation of data quality indicators are reviewed.

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1.0 INTRODUCTION

The "Acid Precipitation Act of 1980" (Title VII of P.L. 96-294) established a long-term interagency program to coordinate and expand research on problems posed by acid deposition in and around the United States. Among the priority research objectives that Congress identified for this National Acid Precipitation Assessment Program (NAPAP) was the development of a nationwide emissions inventory of sources that may contribute to the formation of acid precipitation.

NAPAP is composed of eight task groups, each having specific technical responsibilities. The Task Group on Emissions and Controls is responsible for providing an inventory of 1985 emissions from sources thought to be important in acid deposition processes to other NAPAP Task Groups and to Federal and State government agencies. The United States Environmental Protection Agency (EPA) has the principal responsibility for developing the point and area source emission estimates upon which the emissions inventory will be based and for developing the 1985 emissions inventory. EPA is working with State air pollution control agencies to obtain much of the point source emissions inventory data.

1.1 Purpose of This Report

This quality assurance and quality control (QA/QC) report has been developed to identify the specific objectives that must be met to create a comprehensive and accurate 1985 emissions inventory. The plan therefore provides a guideline for the inventory developers on the level and focus of quality assurance needed for the 1985 emission inventory. In addition, it provides users with an indication of the quality to be expected in the inventory.

1.2 Emission Inventories and EPA's Quality Assurance and Quality Control Program

This report represents a pioneering effort to agree on a QA/QC program for emission inventory projects within EPA. Current EPA QA/QC requirements govern the acquisition of environmentally related measurements but not the emission estimates that form the basis of most emission inventory information. The conceptual framework for this report has been adapted from the QA/QC elements developed for emission measurements and from an earlier scoping study identifying QA/QC approaches to emission inventory activities.[1] Thus, the plan outlined in sections 2.0-8.0 of

this report represents a challenge to EPA and State emission inventory teams to implement QA/QC procedures that have not been a part of previous emission inventory efforts.

EPA's current QA/QC program on emission measurements was initiated in May 1979. Detailed program requirements were issued in April 1984 under EPA Order 5360.1, "Policy and Program Requirements to Implement the Mandatory Quality Assurance Program." This order was developed to ensure that all environmental measurements conducted by EPA's Regional Offices, program offices, laboratories, contractors, and other sources resulted in data that were both scientifically valid and defensible. Valid and defensible data would include documentation about measurement precision, accuracy, representativeness, and comparability, as well as sample custody.

The stringency of these requirements varies with the use of the measurements being made. The most stringent requirements are reserved for engineering and environmental measurements that might be incorporated into EPA regulatory, enforcement, legal, or policy decisions.

Table 1 illustrates the elements of a typical QA/QC plan for engineering research or development projects that might be used for EPA policy decisions. Almost half of these elements (i.e., elements 3, 5, 7, 8, 10, 11) focus on topics intrinsic to environmental measurements: measurement equipment, calibration procedures, analytical procedures, data reduction, equipment performance audits, and preventive maintenance checks.

These elements have no counterparts in nationwide emission inventory projects based on emissions estimates. In general, the emissions data contained in emission inventories are annual estimates that have been developed by multiplying emission factors by activity indicators such as fuel consumption, by extrapolating short term test data, or by using engineering judgement. Thus, the traditional QA/QC approach that was developed for environmental measurements such as emission tests is not workable for emissions inventories.

Table 2 illustrates the large scope of the National Emissions Data System (NEDS) which contains emissions estimates for about 200,000 different point sources alone. On the average, 50 different items of data are collected for each point source. The final NEDS database for 1985 is estimated to contain about 10 million elements. Given the magnitude of this database, manual QA/QC review of emission data must be replaced with automated data handling and QA/QC procedures. Therefore, the QA/QC procedures appropriate for emissions inventories must rely extensively on the use of computers.

TABLE 1

Quality Assurance/Quality Control Elements for
Engineering Research and Development Project Plans

1. Project objectives and constraints
2. Project and QA/QC organization
3. Data quality objectives for measurements
4. Sampling procedures
5. Calibration procedures and frequency
6. Sample custody
7. Analytical procedures
8. Data reduction, validation, and reporting
9. Internal QA/QC checks
10. Plans for performance and systems audits
11. Preventive maintenance
12. Calculation of data quality indicators
13. Plans for corrective action
14. Plans for QA/QC reports

TABLE 2

National Emissions Data System:
1984 Stationary Point Source Profile[a]

State No.	State	Total No. of Plants	Total No. Plant-Points	Total No. Plant-Point-SCC
01	Alabama	770	3,053	4,078
02	Alaska	312	587	1,181
03	Arizona	229	499	776
04	Arkansas	192	1,075	1,075
05	California	875	11,860	16,498
06	Colorado	885	3,635	4,384
07	Connecticut	261	1,850	2,403
08	Delaware	465	1,234	1,347
09	District of Columbia	69	198	269
10	Florida	275	1,791	2,756
11	Georgia	489	2,107	3,134
12	Hawaii	152	811	1,049
13	Idaho	270	727	1,056
14	Illinois	1,523	14,143	14,169
15	Indiana	1,583	4,985	7,794
16	Iowa	364	5,300	6,169
17	Kansas	2,176	7,992	9,659
18	Kentucky	517	2,804	3,964
19	Louisiana	454	6,274	7,324
20	Maine	595	1,206	1,318
21	Maryland	159	1,599	2,079
22	Massachusetts	2,605	8,028	9,968
23	Michigan	374	5,024	5,943
24	Minnesota	842	4,566	8,691
25	Mississippi	202	409	761
26	Missouri	636	2,550	3,355
27	Montana	113	934	1,176
28	Nebraska	1,151	3,110	3,328
29	Nevada	46	163	221
30	New Hampshire	59	260	331
31	New Jersey	458	23,554	23,557
32	New Mexico	364	1,337	1,337
33	New York	1,196	2,761	3,723
34	North Carolina	1,085	4,079	5,419
35	North Dakota	47	121	139
36	Ohio	1,433	5,405	6,899
37	Oklahoma	411	2,269	3,012
38	Oregon	139	933	933
39	Pennsylvania	1,442	4,232	5,556
40	Puerto Rico	1,206	2,155	2,588
41	Rhode Island	190	392	553
42	South Carolina	1,378	2,765	4,488
43	South Dakota	143	293	459
44	Tennessee	3,144	12,159	15,837
45	Texas	1,656	27,390	28,578
46	Utah	170	895	1,284
47	Vermont	21	159	184
48	Virginia	285	1,796	2,886
49	Washington	576	2,230	3,371
50	West Virginia	416	4,426	4,717
51	Wisconsin	1,095	5,118	7,615
52	Wyoming	150	821	1,054
54	Guam	21	176	245
55	Virgin Islands	15	49	54
	GRAND TOTAL	35,684	204,289	250,744

[a]Source: EPA/OAQPS

Table 3 presents eight recommended QA/QC elements for emission inventory projects. Note that, with the deletion of those elements germane only to environmental measurements, the remaining 8 elements are analogous to the 14 elements listed in Table 1 for engineering project plans.

These eight elements constitute the conceptual framework for the ad hoc EPA emission inventory QA/QC program that has been developed for the 1985 emission inventory. Each of these elements is discussed in the paragraphs below.

1. Project objectives and constraints. This element would include a general description of the emission inventory objectives, constraints (e.g., schedule or resources), and principal intermediate and final work products that will be developed to meet the project objectives. If significant constraints to the attainment of the inventory objectives existed, then the inventory objectives would be prioritized.

2. Project organization. This element would describe the participating agencies in the inventory and quality assurance activities, the line of authority for the inventory project, and a general description of the responsibilities of each participant. A workplan describing the inventory schedule and detailing intermediate workproducts would be included in this element also.

3. Data collection and QA/QC procedures. This element would review the procedures used by the inventory participants to collect, check, and process inventory data. Documents and workshops for inventory participants communicating standardized collection and calculation procedures would be discussed and referenced in this element as well.

4. Data custody. This element would detail the handling of the data from the initial stages of the inventory project when individuals obtain data through the final stage of the project when the final inventory tapes are completed.

5. Data validation and QA/QC checks. This element would discuss the procedures used to validate the computerized data reported for the point and area sources in the inventory. The procedures reviewed should include emissions confirmation status, comprehensiveness of the source data both in terms of missing sources and double counted sources, and the representativeness of the data for the reference year of the inventory project. Procedures followed to make QA/QC checks for invalid data and to identify data items which have been encoded properly, but which are not appropriate for the emission source (e.g., a stack height which exceeds the tallest known stack constructed for that type of source), would be discussed in this element also.

TABLE 3

Recommended Quality Assurance/Quality Control Elements
for Emission Inventory Project Plans

---

1. Project objectives and constraints
2. Project and QA/QC organization
3. Data collection procedures
4. Data custody
5. Data validation and QA/QC checks
6. Internal data handling procedures
7. Calculation of data quality indicators
8. Plans for QA/QC reports and corrective action

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6. Internal data handling procedures. This element would detail procedures for generating emission factors used to calculate source emissions and to resolve the inventory data temporally, spatially, and by pollutant species. The element would also discuss plans for testing newly developed software modules used to perform quality control checks, computer system updates, spatial/temporal/speciation allocations, and other routine inventory data processing activities. Additionally, procedures followed to flag data identified as questionable, establish audit trails, and resolve the question or substitute default values for the original data would be discussed in this element. Finally, plans to develop and maintain a library to store copies of intermediate data, final inventories, and supporting software would be discussed.

7. Calculation of data quality indicators. This element would detail the procedures used to determine the accuracy or uncertainty of the final inventory. This discussion should either include the equations used to calculate the data quality indicators or reference other documents which discuss these equations.

8. Plans for QA/QC reports and corrective action. This element would describe plans to develop QA/QC reports and to review and resolve quality assurance and quality control questions and problems that have been identified with the inventory data or inventory methodologies (e.g., problems with area source estimation methodologies).

1.3 Structure of This Report

The succeeding sections of this report are patterned after the eight elements discussed above. Section 2 presents the objectives, constraints, and priorities for the 1985 emissions inventory. Section 3 reviews the organization and responsiblities of the inventory team. Section 4 discusses data collection, custody, and quality assurance procedures. Section 5 delineates the various QA/QC checks planned for the inventory data. Section 6 outlines the internal data handling procedures that have been developed for the 1985 inventory project. Section 7 discusses the data quality indicators that will be employed to determine inventory accuracy or uncertainty. Section 8 identifies plans for QA/QC reports and the review/reconciliation of QA/QC problems by the inventory team. Finally, Section 9 presents the references discussed in the body of the report.

2.0 OBJECTIVES AND CONSTRAINTS FOR THE 1985 NAPAP EMISSION INVENTORY

The objective of the 1985 NAPAP emission inventory is to compile a comprehensive and accurate inventory of emissions and facilities data from natural and anthropogenic sources for the 1985 base year. The inventory will be developed from intermediate data bases of both point and area sources in the United States and Canada up to 60 degrees North Latitude. Transboundary point and area source emissions from Mexico may be included in the inventory as well.

This inventory is being developed to serve several needs that have been articulated by EPA and NAPAP. Both NAPAP and EPA want to develop point and area source data bases with emissions estimates that have been confirmed by the participating sources and States. Additionally, NAPAP wants to use the inventory that will be developed from these data bases in an atmospheric process model that will analyze relationships between emissions and acidic deposition.

The vast majority of the 1985 emissions data that must be generated to compile the emissions inventory correspond to anthropogenic point and area sources in the United States. This data will be developed by EPA, which has the statutory authority to collect it. Under Title 40 of the Code of Federal Regulations, Part 51, Sections 51.321 - 51.323, States are required to report to EPA source and emissions data for facilities that emit more than 100 tons of SO_2, NO_x, reactive VOC, and particulate matter, or more than 1000 tons of CO in a calendar year. The system that has been established to encode, transmit, and report these data is known as the National Emissions Data System (NEDS). EPA's Office of Air Quality Planning and Standards (OAQPS) has the responsibility for maintaining NEDS and for developing estimates of area source emissions.

Canadian point and area source emissions data for 1985 will be compiled by Environment Canada and transmitted to EPA. The United States EPA will be responsible for obtaining from Mexico 1985 point and area source emissions from northern Mexican sources that contribute to transboundary pollution.

2.1 Inventory Data Quality Objectives

NAPAP has specified the data quality objectives that the emissions inventory must meet to provide meaningful inputs to its research activities.[2] In general, those requirements can be divided into support for assessment activities and support for the Eulerian Atmospheric Modeling.[3] These objectives include: development of point and area source data bases with high levels of accuracy and comprehensiveness; characterization of each source by geographic sector and by spatial location; and allocation of emissions in the point and area source data bases temporally, spatially, and by pollutant species. Additional information on temporal, spatial, and pollutant species objectives is summarized in Table 4.

To satisfy these objectives, the 1985 inventory must be compiled on a Source Classification Code (SCC) sub-point emission level. This level of detail is essential to accurately quantify the point and area source emissions and to enable resolution of the data temporally and by pollutant subspecies. The accurate location of these emissions geographically and spatially requires knowledge of both the geographic coordinates of the source and the source's emission injection and transport parameters (i.e., stack height, stack diameter, flow rate, and exhaust gas temperature).

2.2 Inventory Constraints

Four broad programmatic and technical constraints will affect the attainment of these objectives:

1. NAPAP's timetable for using the results of the 1985 inventory. This schedule calls for the inventory to be assembled, documented, and peer reviewed by January 1988. This schedule constraint creates a significant challenge for most States to complete their 1985 inventory submittals to NEDS much earlier than has been the case for NEDS submittals for past calendar years. In some instances, the NAPAP schedule calls for States to complete their NEDS submittals a year earlier than usual.

2. A shortfall in resources needed to meet NAPAP's inventory schedule and objectives. The problems created for the States generally involve a lack of staff, financial resources, or program flexibility to develop a 1985 data base at an accelerated pace. To explore the extent of this problem, NAPAP and EPA collaborated with the State and Territorial Air Pollution Program Administrators to survey each State's needs.[4] This survey indicated that States would require about $2 million in direct financial or contractor assistance to try to complete their 1985 NEDS submittals by July 1986. The survey also indicated that this amount could be reduced significantly if the submittal date was postponed from July to September 1986.

TABLE 4

NAPAP 1985 Emissions Inventory Data Quality Objectives

	Emissions Inventory for Support of Assessment Activities	Emissions Inventory for Support of Eulerian Atmospheric Modeling
Geographic Domain	48 U.S. States, Canada, and Northern Mexico	Same
Temporal Resolution	Annual/seasonal	Hourly emissions values for typical weekday, Saturday, and Sunday for all four seasons
Spatial Resolution	Coordinates for point sources; area sources at the county level in the U.S. and at the province level in Canada; natural sources at county, state, or province level; release height	Coordinates for point sources; area sources assigned to 20 x 20 km grid cells; release height
Species	SO_2, NO_x, reactive VOC	SO_2, SO_4, TSP (Ca, Mg, K, Na), Pb, CO, HCl, HF, NO, NO_2, NH_3, VOC (methane, ethane, ethylene, propane, propylene, N-butane, 1,2-butane, isobutane, isobutene, trans-2 butene, pentane, isopentane, 2,3-dimethylbutane, other alkenes, other alkanes, formic acid, acetic acid, other organic acids, formaldehyde, acetaldehyde, propionaldehyde, acetone, other ketones, other aldehydes, xylene, benzene, toluene, ethylbenzene, other aromatics), natural emissions (S, alkaline dust, NO_x from lightning and biota, isoprene, 4 major turpines, NH_3)
Sources	Anthropogenic stationary sources emitting >100 tons of criteria pollutants in 1985; area source estimates for small stationary and mobile sources; natural sources	Same

In response to these survey results, NAPAP and EPA postponed the submittal date until September 1986 and have been able to provide to the States a part of the assistance that they requested. EPA has provided $500,000 in direct financial assistance through Clean Air Act Section 105 grants and NAPAP has provided a matching sum in the form of contractor assistance. Although this assistance will ensure that many of the data quality objectives for the 1985 inventory are met, it will not be adequate to ensure that all will be met or that they will be met according to NAPAP's schedule.

3. Scheduling the resources needed for the "quality assurance loop" for United States anthropogenic sources. This loop requires the participation of both States and EPA Regional Offices to resolve any problems identified by the NEDS or NAPAP QA/QC checks. Previous NEDS inventories have not required States to play a significant role in resolving QA/QC problems. States therefore may have problems in estimating or scheduling the resources needed to assist with the resolution of questions raised in the QA/QC checks.

In anticipation of this problem, NAPAP and EPA have taken three initiatives. The first is to develop a new computerized routine to check for as many of the NAPAP data quality objectives as possible in the NEDS data. The second is to ask States to participate in resolution of data quality problems only for the largest sources (generally, those that emit at least 1000 tons of SO_2, NO_x, or VOC). The third is to provide for contractors to help resolve QA/QC problems in States where outside assistance is needed.

4. Lack of emission factors. Some anthropogenic sources of reactive VOC emissions and many natural sources do not have the necessary emission factors available which will reduce the accuracy and completeness of emissions estimates for these sources.

2.3 Inventory Priorities

These constraints make it likely that inventory participants will not be able to obtain the necessary point and area source data to meet all the data quality objectives for the 1985 inventory. Therefore, to ensure that the data quality objectives considered important by NAPAP and EPA receive the most attention, NAPAP developed guidelines to help the States effectively allocate their limited staff resources. These guidelines, which are summarized in Table 5, were distributed to all the inventory participants.

In addition to these guidelines, EPA developed performance standards for each of the EPA inventory participants which define minimum performance targets for the 1985 NEDS submittals. In general, these standards require that NEDS submittals for all sources that emit more than 1000 tons of SO_2,

TABLE 5

1985 Emissions Inventory Priorities

Facility Size	Completeness	Emission Estimates					Correct SCC	Control Equip/ Effic	Fuel and Operating Data	Location Data	Stack Data	Temporal Data	Other Key Data	Confirm	SIC
		SO_x	NO_x	VOC	TSP	CO									
I >500 TPY VOC & >1000 TPY OTHERS	H	H	H	H	M	L	H	H	H	H	1	H	M	2	L
II >100 TPY ALL	M	3	3	4	M	L	H	3	3	H	M	M	L	L	L

PRIORITY: H = HIGH M = MEDIUM L = LOW

1 HIGH for stacks $\geq$ 100 feet, LOW for stacks < 100 feet.

2 HIGH for facilities with emissions of SO_2 & NO_x > 2500 tons per year.

3 HIGH for combustion sources, MEDIUM for other industries.

4 HIGH for petroleum refineries and chemical processors, MEDIUM for other industries.

NO_x, and reactive VOC in calendar year 1985 be comprehensive (i.e., no sources omitted), pass specified data quality checks, contain 1985 actual emissions data, and include a confirmation status report for each source that emits more than 2500 tons of SO_2 or NO_x.

An analysis of this performance standard indicates that these emission levels correspond to a high percentage of the total national mass emissions in each pollutant category. This analysis is summarized in Table 6.

TABLE 6

Analysis of Point Source Emission Levels and Corresponding Inventory Coverage[a]

Pollutant	Size Range, tons/yr	No. of Plants	Cumulative % of Total Point Source Emissions[b]	Cumulative % of Total Emissions[c]
SO_2	>2500	942	88.1	89.2
	>1000	1511	92.0	92.7
NO_x	>2500	695	80.2	90.5
	>1000	1274	87.7	94.1
VOC	>2500	279	43.6	89.5
	>1000	723	61.3	92.8
	>500	1331	72.8	94.9

[a]Source: EPA/OAQPS

[b]Basis: 1983 NEDS point source data

[c]Basis for calculation:

Cumulative % = [cumulative 1983 point source emissions > size range + 1982 area source emissions] divided by [total 1983 point source emissions + 1982 area source emissions]

3.0 PROJECT ORGANIZATION FOR THE 1985 EMISSIONS INVENTORY

The organization that has been developed to produce the 1985 emissions inventory can be viewed in two ways. The first is to detail the participants in the project, and the general inventory tasks for which each participant will be responsible. This is done is section 3.1. The second is to discuss the workplan and schedule that have been developed to coordinate the inventory project and to ensure that it is completed according to the NAPAP timetable. This is done in section 3.2.

3.1 Inventory Participants and Responsibilities

Compilation of the 1985 NAPAP emission inventory will require substantial effort from a number of State and Federal agencies. Figure 1 presents a line diagram of the interactions and management functions of the various groups involved in the inventory compilation and quality assurance efforts.

Individual State air pollution control agencies will have a primary role in the inventory development by obtaining and supplying new 1985 NEDS data, through their respective EPA Regional Offices (RO's), to EPA's Office of Air Quality Planning and Standards (OAQPS). For many States, this effort will require contacting each major source, obtaining detailed emissions and facilities data for each point within that source, obtaining confirmation of plant emission totals, encoding the NEDS data onto NEDS forms, and checking the forms for errors. Additionally, States will be asked to help NAPAP resolve any questions about the NEDS data that have been identified for sources that emit at least 1000 tons of SO_2, NO_x, and reactive VOC.

EPA Regional Offices will have important communication, management, and quality assurance roles during the inventory as well. Emission inventory participants in each Regional Office will communicate inventory objectives and written guidance to their respective States, establish schedules for each State to complete and submit its NEDS and confirmation status data, help manage the distribution of the financial and contractural assistance that their States have requested, edit the State NEDS submittals to identify and resolve errors, and forward the State NEDS data to OAQPS. Finally, if OAQPS or NAPAP subsequently identifies questions or problems with the NEDS data for the sources mentioned above, the Regional Offices will assist with resolution of the problems.

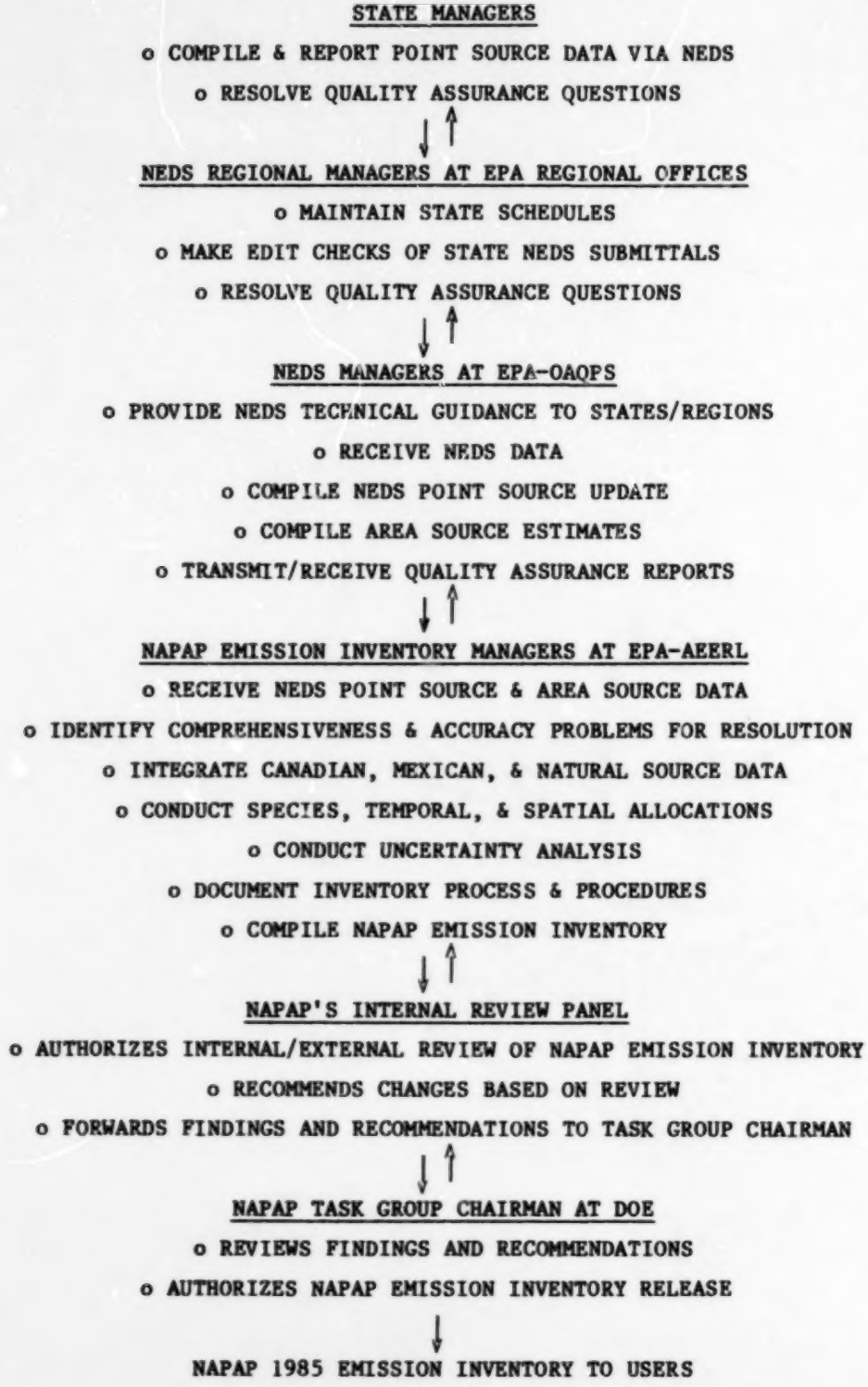
STATE MANAGERS
o COMPILE & REPORT POINT SOURCE DATA VIA NEDS
o RESOLVE QUALITY ASSURANCE QUESTIONS
NEDS REGIONAL MANAGERS AT EPA REGIONAL OFFICES
o MAINTAIN STATE SCHEDULES
o MAKE EDIT CHECKS OF STATE NEDS SUBMITTALS
o RESOLVE QUALITY ASSURANCE QUESTIONS
NEDS MANAGERS AT EPA-OAQPS
o PROVIDE NEDS TECHNICAL GUIDANCE TO STATES/REGIONS
o RECEIVE NEDS DATA
o COMPILE NEDS POINT SOURCE UPDATE
o COMPILE AREA SOURCE ESTIMATES
o TRANSMIT/RECEIVE QUALITY ASSURANCE REPORTS
NAPAP EMISSION INVENTORY MANAGERS AT EPA-AEERL
o RECEIVE NEDS POINT SOURCE & AREA SOURCE DATA
o IDENTIFY COMPREHENSIVENESS & ACCURACY PROBLEMS FOR RESOLUTION
o INTEGRATE CANADIAN, MEXICAN, & NATURAL SOURCE DATA
o CONDUCT SPECIES, TEMPORAL, & SPATIAL ALLOCATIONS
o CONDUCT UNCERTAINTY ANALYSIS
o DOCUMENT INVENTORY PROCESS & PROCEDURES
o COMPILE NAPAP EMISSION INVENTORY
NAPAP'S INTERNAL REVIEW PANEL
o AUTHORIZES INTERNAL/EXTERNAL REVIEW OF NAPAP EMISSION INVENTORY
o RECOMMENDS CHANGES BASED ON REVIEW
o FORWARDS FINDINGS AND RECOMMENDATIONS TO TASK GROUP CHAIRMAN
NAPAP TASK GROUP CHAIRMAN AT DOE
o REVIEWS FINDINGS AND RECOMMENDATIONS
o AUTHORIZES NAPAP EMISSION INVENTORY RELEASE
NAPAP 1985 EMISSION INVENTORY TO USERS

Figure 1. Interactions in NAPAP 1985 emissions inventory.

The NEDS data for each State will be incorporated into the computerized 1985 NEDS point source data base by OAQPS. OAQPS will update the NEDS file, and will transmit the resulting data base and the confirmation status reports from each State to the NAPAP inventory manager in EPA's Air and Energy Engineering Research Laboratory (AEERL). OAQPS will also be responsible for developing an area source data base comprised of emissions estimates for each county and area source category in the United States and for transmitting it to AEERL. Additionally, OAQPS will be responsible for making any necessary changes to the area source estimating methodologies and to the computerized edit checking routines that scan the State NEDS data. Finally, OAQPS will help AEERL communicate with the Regional Offices and States about quality assurance questions or problems and about the area source emission estimates.

After receipt of the point and area source data bases from OAQPS, AEERL will perform the NEDS edit checks created to check for NAPAP's data quality objectives and will perform additional quality assurance checks for data accuracy, comprehensiveness, and errors. AEERL will flag questionable data items for resolution, and will establish an audit trail for each item that will ultimately document the changes made to the items. AEERL will prepare a quality assurance report for each State's NEDS submittal, and will transmit the reports to OAQPS for distribution to the States. AEERL will computerize each State's confirmation status reports with the NEDS point source data base. AEERL will evalutate the methodology used to estimate United States area source emissions, and will report any recommended changes to OAQPS. Additionally, AEERL will develop any factors (i.e., temporal, spatial, pollutant species) needed to translate the point and area source data bases into the United States emissions inventory. AEERL will evaluate State comments on the area source emission estimates.

AEERL will be responsible also for integrating the Canadian point and area source data bases and the United States natural source emissions inventory with the United States anthropogenic emissions inventory, and for integrating corresponding anthropogenic data bases for northern Mexico. AEERL will be responsible for ensuring that these data bases are subject to quality assurance checks that are analogous to those developed for the United States data. AEERL will be responsible for documenting the resulting emissions inventories and for maintaining copies of the inventories and the various associated software routines.

Upon completion of this documentation, AEERL will develop a methodology to assess the uncertainty of the inventory emissions estimates and will estimate this uncertainty. AEERL will transmit the inventories and the results of the uncertainty analysis to the Internal Review Panel for NAPAP's Task Group on Emissions and Controls.

The Internal Review Panel will conduct a detailed review of the inventories, the supporting documentation, and the uncertainty estimates. The panel's recommendations will be forwarded to the Task Group chairman for evaluation and action. The Task Group chairman will be responsible for authorizing release of the final 1985 NAPAP emission inventory.

3.2 Inventory Workplan and Schedule

Given the broad scope of activities and large number of participants that that must be coordinated to complete the 1985 emissions inventory, a detailed workplan is required to identify and schedule them. This workplan is presented in Table 7. It includes the State and federal agencies participating in the inventory and Environment Canada. It encompasses 45 tasks that must be accomplished before the 1985 inventory can be completed. It covers the remaining two-year timespan for the inventory, but does not include inventory planning, budgeting, and communication activities that were completed in 1985.

This workplan is being presented for two reasons. The first is to illustrate that the major inventory tasks and their respective participants have been identified and coordinated within the NAPAP timeframe. The second is to identify the inventory quality assurance components and schedule. These will be discussed in section 4 of this report.

The workplan includes a number of significant QA/QC activities and milestones. These activities are illustrated below in a discussion of activites for the development of the point source data base for the United States. In general, these activities have been selected and structured to ensure that they are performed as close to the source of the inventory data as possible.

First, States will compile their 1985 NEDS data and confirmation status reports, check the data for errors and omissions, and transmit the NEDS data and reports to the EPA Regional Offices by the end of September 1986. About half of the States have indicated that their data will be submitted significantly in advance of this date; a few States will submit their data one or two months beyond this date due to programmatic constraints.

Second, the Regional Offices will subject the NEDS submittals to a computerized edit checking routine and enlist State help in resolving problems or errors identified. The Regional Offices will transmit the data and reports to OAQPS, which will create the 1985 NEDS updates for AEERL.

Third, AEERL will subject the NEDS file to the computerized NEDS edit check a final time and to additional quality assurance checks, and create QA/QC reports for each State by the end of January 1987. These reports will summarize the source data reported by State and identify any remaining quality assurance problems.

TABLE 7

1985 Emissions Inventory Workplan and Schedule

Task No.	Task Name	1986 Schedule J F M A M J J A S O N D / 1987- J F	Lead Program Office
1	Complete Allocation of State Assistance to EPA RO's	..... 03/15	OAQPS
2	Complete Scheduling of State NEDS Submittals	..... 03/31	RO
3	Complete NEDS/EIS Software Modifications	..... 05/30	OAQPS
4	Complete NEDS NE061 Emission Calculation Software	..... 05/30	OAQPS
5	Complete Development of NAPAP QA/QC Files and Software	..... 05/30	AEERL
6	Complete Distribution of NE061 Software and Utility Data to States	..... 06/30	AEERL
7	Complete Testing of NAPAP QA Software	..... 07/30	AEERL
8	Complete Improvements to Area Source Estimation Procedures	..... 08/30	OAQPS
9	Complete Documentation of 1985 Area Source Procedures	..... 08/30	AEERL

J F M A M J J A S O N D J F
1986 Schedule / 1987-

(Continued)

TABLE 7 (Cont'd)

Task No.	Task Name	1986 Schedule J F M A M J J A S O N D | 1987 J F	Lead Program Office
10	Complete Transmittal of Area Source Methodology to States/ RO's for Review	.....• 09/30	OAQPS
11	Complete Acquisition of Polk Tapes for Area Source Estimates	.....• 09/30	OAQPS
12	States Complete Submittal of NEDS SPMS Data and Confirmation Status Reports to RO's	.....• 09/30	States/RO
13	Edit Check, Correct, and Submit Required Data (NEDS/Confrm. Status) to NADB	• 10/31 (unless otherwise negotiated)	RO
14	Complete NEDS Updates with Data as Received and Transmit to AEERL with Confirmation Reports	.....• 11/30	OAQPS
15	Create NAPAP Point Source File, Verify Against NEDS File, and Run NE061 Edit Check	• 12/15	AEERL
16	Complete Development of Temporal/Spatial/ Species Allocation Factors	• 12/31	AEERL

J F M A M J J A S O N D J F
1986 Schedule -|-1987-

(Continued)

TABLE 7 (Cont'd)

Task No.	Task Name	- 1986 - N D	1987 Schedule J F M A M J J A S O N D	Lead Program Office
17	OAQPS Briefing on State NEDS Submittals	.....• 12/31		OAQPS
18	Complete Reports of NEDS QA/QC Problems, Review, and Send to OAQPS	.....• 01/31		AEERL
19	Meet to Evaluate NEDS QA/QC Problems	.....• 02/07		AEERL/OAQPS
20	Complete NO_x/VOC Default Emission Factors File	.....• 02/15		AEERL
21	Complete Transmittal of QA/QC Reports to RO's and States	.....• 02/15		OAQPS
22	Receive State/RO Comments on Area Source Methodology	.....• 02/28		OAQPS
23	Complete Evaluation of State/RO Comments on Area Source Methodology	.....• 03/31		AEERL
24	Integrate Confirmation Status Reports into NAPAP Point Source File	• 03/31		AEERL

N D J F M A M J J A S O N D
- 1986 - |---------- 1987 Schedule ----------

(Continued)

TABLE 7 (Cont'd)

Task No.	Task Name	- 1986 - N D	1987 Schedule J F M A M J J A S O N D	Lead Program Office
25	States Complete Transmittal of QA/QC Responses to RO's		.....• 04/30	States/RO
26	Complete Transmittal to OAQPS of State Responses to QA/QC Problems		.....• 05/15	RO
27	Complete Evaluation of QA/QC Report Response		.....• 06/01	AEERL
28	Complete NEDS Point Source Data Base and Send to AEERL		.....• 06/15	OAQPS
29	Complete NAPAP Point Source Data Base		.....• 07/15	AEERL
30	Complete Software for Processing Canadian Inventory Data		.....• 07/15	AEERL
31	Complete Area Source Data Base and Send to AEERL		.....• 08/15	OAQPS
32	Complete QA of NEDS Area Source Data Base		.....• 08/30	AEERL

N D J F M A M J J A S O N D
- 1986 - 1987 Schedule

TABLE 7 (Cont'd)

Task No.	Task Name	1987 Schedule J F M A M J J A S O N D	1988 J F	Lead Program Office
33	Complete Transmittal of NEDS Area Source Estimates and Send Summary Reports to States for Comment	° 08/30		OAQPS
34	Complete NAPAP Area Source Data Base	° 09/15		AEERL
35	Canadian 1985 Inventory Transmitted to AEERL	..° 09/30		AEERL
36	Receive Comments on Area Source Database	..° 09/30		OAQPS
37	Complete QA/QC and Integrate Mexican/Canadian Inventory	.....° 10/30		AEERL
38	Complete QA/QC and Integrate Natural Source Inventory	.....° 10/30		AEERL
39	Apply Species, Spatial, Temporal Allocation Methodology	.....° 10/30		AEERL
40	Complete Documentation for 1985 NAPAP Emissions Inventory	.....° 10/30		AEERL
41	Complete QA/QC Checks of 1985 NAPAP Emissions Inventory Modeler's Tape	.....° 11/15		AEERL

(Continued)

TABLE 7 (Cont'd)

Task No.	Task Name	1987 Schedule J F M A M J J A S O N D	1988 J F	Lead Program Office
42	Complete Evaluation of State Comments on Summary Reports and NEDS Area Source Data Base	...• 11/15		AEERL
43	Complete Uncertainty Analysis of NAPAP Emissions Inventory	....• 11/15		AEERL
44	Complete NAPAP/EPA Peer Review of 1985 Point and Area Source Data Bases and NAPAP 1985 Emissions Inventory	.....•12/31		NAPAP
45	Respond to Comments of NAPAP Peer Review Panel		•01/88	AEERL
46	Release 1985 NAPAP Emissions Inventory (Version 1) to Users		•01/88	NAPAP

	J F M A M J J A S O N D	1988 J F
	1987 Schedule	

Fourth, States and EPA Regional Offices will be asked to correct these remaining problems. In general, resources will be focused on resolving any problems identified for the SO_2, NO_x, and reactive VOC sources with at least 1000 tons of emissions in 1985. Time and resources permitting, problems for smaller sources may be addressed as well.

Fifth, States and EPA Regional Offices will complete this final quality assurance review/revision by April and May of 1987, respectively. After these final responses have been received, OAQPS will complete the NEDS point source data base in June 1987. A post-edit report of the point sources and their emissions will be transmitted to each State.

Following compilation of the point source data, OAQPS will estimate area source emissions which will be reviewed by AEERL, States, and Regional Offices. Finally, AEERL will merge Canadian, Mexican, and natural source emission estimates. Appropriate species, spatial, and temporal allocation factors will also be applied along with uncertainty indicators to develop the 1985 NAPAP emission inventory. After satisfying peer review requirements by EPA and NAPAP, the emission inventory will be released to users.

4.0 DATA COLLECTION, CUSTODY, AND QUALITY ASSURANCE/QUALITY CONTROL

This section discusses the procedures established to collect, transmit, check, and correct the point source data for the United States. Chronologically, these procedures began in 1985 (when recommended inventory procedures were transmitted to the States) and will end in 1987 (when a post-edit report of point source emissions is transmitted to inventory participants). The major elements of the data collection and custody procedures are presented in Table 7.

To ensure that the State NEDS submittals are as accurate, complete, and consistent as possible, EPA and NAPAP have developed and communicated written technical guidance to the States and EPA Regional Offices on several aspects of the inventory. This guidance includes:

- a review of NEDS reporting and edit checking procedures;[5]
- recommended methods and procedures for developing 1985 SCC-level emissions data and confirmation status reports;[6]
- recommended guidance for the compilation of hydrocarbon emission estimates to eliminate confusion over reporting total or reactive VOC;[7]
- a description of NAPAP inventory priorities, confirmation procedures, and the QA/QC checks of State NEDS data that will be different from the NEDS edit checks;[8,9] and
- the compilation and distribution of 1985 utility data to assist States in reviewing their NEDS utility data.

These procedures are discussed in detail in the literature cited above. Additionally, a workshop for EPA, NAPAP, and State participants in the 1985 inventory was conducted on October 24-25, 1985, to provide each participant an opportunity to review and discuss much of this guidance. Another workshop, for all contractors assisting States in data collection, was held on May 1, 1986.

A critical step in the collection of the inventory point source data occurs in the summer and fall of 1986. During this time, States will compile their 1985 NEDS data and confirmation status reports and check the data for errors and omissions. The data and reports will then be submitted

to the EPA Regional Offices by the end of September 1986. Many States will submit their data before this date; a few must submit it one or two months later than this date due to programmatic constraints.

Next, the Regional Offices will subject the NEDS submittals to the NEDS computerized edit checking routine[10] (known as NE061) and enlist State help in resolving problems or errors identified. Resolution of any questions identified by this QA/QC check should be completed by the end of October 1986. The Regional Offices will transmit the NEDS transactions and confirmation status reports to OAQPS.

During the third step of the collection and custody process, OAQPS will update the State NEDS data to create a NEDS point source file by the end of November 1986.

Once the State data are in the point source file, a tape of the file will be transmitted to AEERL. This tape will be in a format that will permit transmission of SCC level emissions. Files for each State may be transmitted to AEERL individually or in small groups. AEERL will enter the file into its data base and subject it to quality assurance checks. Initially, AEERL will perform the NEDS edit checks on the State NEDS data to verify that problems identified by the Regions have been resolved. Other QA/QC checks are discussed in section 5 of this report. At this time a computerized audit trail of QA/QC problems will be established which will document either the resolution of the problem or the substitution of default values if this action becomes necessary.

A QA/QC report of potential problems will be prepared for each State by the end of January 1987. These reports will focus generally on sources that emit at least 1000 tons of emissions in 1985. Included in the report will be summary lists of sources and plant level emissions totals. These lists will document the plant level NEDS data for each State as they were received by NAPAP. These reports will be discussed by NAPAP, AEERL, and OAQPS before they are transmitted to the Regional Offices and States.

During the final step of the collection process, EPA Regional Offices, States, and NAPAP contractors will cooperate to correct problems identified by the NAPAP QA/QC checks. In general, Regional Offices and States will be expected to resolve problems for the SO_2, NO_x, and reactive VOC sources with at least 1000 tons of emissions in 1985. The States will provide to their Regional Office the appropriate revisions to the "problem" NEDS data in the form of NEDS update transactions by June 15, 1987. Time and resources permitting, problems for smaller sources may be addressed as well.

Depending on the nature and extent of the revisions, OAQPS will transmit either the "corrected" NEDS file or the updates themselves to AEERL by June 15, 1987. This transmittal will constitute the NEDS point source data base.

AEERL will review the updates or the corrected file to determine if the QA/QC problems were resolved. At this time, AEERL will substitute default values for those problems that were not resolved. In either case, the audit trail will record the change made. This will constitute the NAPAP point source data base.

The data collection and custody procedures for area source smissions are much less detailed than those described above for point source emissions since area source emission estimates are conducted by OAQPS rather than by each State. After OAQPS calculates the area source estimates, a tape containing estimates of the criteria pollutants by county for each State will be transmitted to AEERL. Upon receipt of the tape, AEERL will review the area source emission estimates and will report any QA/QC problems to OAQPS for review.

The final step in the data collection process for both point and area sources will be to generate a post-edit report of each State's point and area source emissions. This report will summarize plant level and area source emissions and totals by county and emission category. States will be given the opportunity to review and comment on this report. This last step will close the "quality assurance loop" in which the various agencies working on the inventory have participated.

5.0 DATA VALIDATION AND QA/QC CHECKS

This section reviews the QA/QC checks that will be applied to the United States, Canadian, and Mexican point and area source data bases. Completeness confirmation checks are discussed, as are QA/QC checks for invalid and inappropriately encoded inventory data.

5.1 Point Source Data Base

Many of the QA/QC checks that will be performed on the 1985 NEDS data will be computerized. Most of these checks are contained in the NEDS edit software that EPA runs on the State NEDS submittals. A detailed list of these edit checks is included in the NEDS Edit User's Guide.[10] However, NAPAP plans to supplement these edit checks with nine additional categories of quality assurance checks. These checks will be performed after the NEDS file created for the 1985 Emissions Inventory has been received by NAPAP. The categories, and some of the checks in each, are described below.

Manual Sorting. The NEDS file will be subdivided into two categories: sources that emitted at least 1000 tons in 1985, and sources that emitted less than this amount. In general, NAPAP's QA/QC reports to the States will focus on SO_2, NO_x, and VOC sources that emitted more than 1000 tons in 1985. However, for States that have few sources above this "cutoff," the reports may address smaller sources.

Calendar Year. Source data above the cutoff will be screened to determine whether the year of record is 1985. Emissions data (from NEDS card 4) with a year of record other than 1985 will be flagged for investigation with the State. Data below the cutoff will be screened to develop a profile of years of record.

UTM Coordinates. All UTM coordinates will be checked against county boundaries. Incorrect or missing UTM coordinates will be flagged for discussion with the State. County centroids will be substituted for the incorrect data pending determination of the correct coordinates.

Completeness. NAPAP will develop an independent list of sources (e.g., NSPS files, the National Utility Reference File) in each State above the 1000 ton cutoff and will compare this list with NEDS source data to ensure that no sources have been inadvertently omitted. Any apparent discrepancies will be flagged for discussion with the State.

Large Source Checking. NEDS data for utilities and smelters will be compared with independent data sources (e.g., DOE EIA 767 data) for consistency in location, stack, activity, and emissions data. Significant inconsistencies will be flagged for discussion with the State.

Emissions Sorting. NEDS data for each State will be displayed in order of descending emissions to facilitate checking for invalid emissions data or other NEDS data associated with emissions. Apparently invalid data will be flagged for discussion with the State.

"Statistical" Sorting. NEDS stack, control device, efficiency, emissions, and activity data for a given source will be checked against mean values for that SCC combination. Emissions data will be normalized for operating activity to check for emissions at a given capacity factor. Data that fall more than 2 standard deviations outside of the mean for that SCC will be flagged for investigation. Apparently invalid data will be flagged for discussion with the State.

SCC Sorting. SCC data in NEDS will be compared with other available data to ensure appropriateness. While NE061 will reject an invalid code number, this check will try to identify valid numbers that have been inappropriately assigned. SCC's with known emissions will be flagged for investigation when NEDS data indicate that emissions are reported to be zero.

Emissions Checking. Reported NEDS emission estimates will be checked against emissions calculated from NEDS operating rate and fuel data using the NEDS SCC Emissions Factor File.

A significant QA check that will be performed on 1985 NEDS data is the confirmation of emissions data for large sources. The purpose of this confirmation process is to provide an opportunity for the sources to review State emissions estimates that will be submitted to EPA. Such an opportunity to agree with or to improve the emissions estimates will produce higher quality data and will promote confidence in the data by all parties involved in the inventory. Resource constraints in the EPA-State inventory team have limited this confirmation effort to sources of SO_2 and NO_x that emit more than 2500 tons in 1985. States will submit a summary report with their NEDS submittal documenting the confirmation status of each of these large sources.

5.2 Area Source Data Base

Area source estimates for each U.S. county are compiled by OAQPS. The compilation process involves well-documented procedures and internal quality assurance checks. As a result, the QA/QC of U.S. area sources will have a different focus from that of point sources. A comprehensive QA/QC review at the level anticipated for point source emissions data

will not be required. Instead, QA/QC efforts will focus on improving the methods used to develop area source emissions estimates, and on documenting these methods. EPA RO's and States will be given an opportunity to review the documentation. Also included in the QA/QC of area sources will be checking of the area source emissions data after they have been entered into the NAPAP area source file to ensure that no data items were lost or misinterpreted during the conversion process. Interested States will be given the opportunity to review and comment on both the area source estimation methodology and the estimates derived for their respective domains. AEERL will review State comments on the estimates and methodology.

Some possible improvements to the NEDS area source estimation methodologies have been identified in previous inventory efforts. These improvements will be implemented for the 1985 inventory. For example, MOBILE3 will be incorporated into NEDS to permit calculation of highway vehicle emissions using the most current mobile source emission factors and algorithms. Part of this effort entails allowing for the incorporation of motor vehicle emissions inspection and maintenance program statistics in the emissions calculations. Improvements to the methods currently used for allocating vehicle miles of travel by county and vehicle class will be made also.

5.3 Canadian Point and Area Source Data Base

Compilation of the Canadian point and area source inventories will be done by Environment Canada. Environment Canada will compile and check the Canadian emissions data, and then transmit them to AEERL. Once incorporated into the NAPAP data base, the Canadian inventory data will be subjected to all the NAPAP QA/QC checks. Detected problems will be discussed and resolved with Environment Canada. Canadian personnel will have the opportunity to review and comment on the final NAPAP emission inventory for Canada.

5.4 Mexican Point and Area Source Data Base

AEERL will integrate available point and area source data bases of Mexican sources that contribute to transboundary pollution into the NAPAP data base. These data will be subjected to all the NAPAP QA/QC checks.

5.5 QA/QC of the Complete Anthropogenic Emissions Inventory

After each State's NEDS submittal has been reviewed and integrated into the 1985 NAPAP Emissions Inventory, QA/QC checks of the entire product will occur. These entail aggregation and graphical representation of the inventory data using software designed for this purpose. These summaries and graphical presentations will be compared with:

- o total fuel use data reported by the DOE;
- o point source and metropolitan area density maps;
- o emissions totals from the 1980 NAPAP and 1982 EPRI emission inventory;
- o county and grid cell emission density maps from the above inventories;
- o spatial patterns from the above inventories;
- o seasonal, daily, and hourly emissions patterns from the above inventories; and
- o VOC species distributions from the above inventories.

The inventory will undergo manual and automated checking for unusually high regional values relative to the entire study area, emissions falling outside the study area, and unusual balances among the different pollutants. Other analyses, such as the scrutiny of statistical outliers, and the temporal distribution of each pollutant by grid, will be conducted also.

5.6 QA/QC of Natural Source Emissions Data

As indicated in Table 4, an inventory of natural source emissions will be included with the anthropogenic emissions inventory. These natural source emission estimates will be obtained from the National Oceanic and Atmospheric Administration as part of their NAPAP sponsored activities. This inventory will undergo checking for unusually high regional values, discontinuities, and emissions falling outside the study area.

5.7 Modeling Tapes

One of the major products of the 1985 NAPAP Emissions Inventory will be modeling tapes to support atmospheric analyses being conducted by NAPAP. Computerized QA/QC checks of these tapes will be extensive. They will include verification that all States, counties, plants, and points are represented in the file; that modeling file emissions totals reflect the corresponding totals from the annual inventory; that emissions totals for individual pollutants reflect the emissions totals on a category basis by State for each pollutant; that all grid cells are represented and their emissions levels, by pollutant, are reasonable; and that all modeling days are covered. QA/QC checks will also include the manual review of data summaries and graphics generated from the modeling tape.

6.0 INTERNAL DATA HANDLING PROCEDURES

This section outlines procedures for three types of data handling that will be conducted by AEERL. Allocation factors used to resolve point and area source emissions spatially, temporally, and by pollutant species are discussed first. Procedures followed to test and document NAPAP inventory software are discussed next. Finally, documentation of the inventory QA/QC process is reviewed.

6.1 Allocation Factors

A major part of the NAPAP QA/QC activity will be to ensure the completeness and accuracy of temporal, spatial, and pollutant sub-species allocation factors. Atmospheric modelers will use these data to provide finer resolution of the emissions data for modeling purposes. While the 1980 NAPAP Emissions Inventory development included substantial review of these factors, they will be expanded and adjusted, where applicable, to reflect 1985 in the upcoming inventory development effort. Because of the importance of allocation factors, substantial effort will be focused on their improvement. Specific QA/QC measures relating to this effort are described separately below. Allocation factors applied to Canadian emissions data, in addition to undergoing the following specific QA/QC checks, will be provided to the Canadians for review and comment.

6.1.1 Spatial Allocation Factors

Spatial allocation factors apportion county level area source emissions to grid cells on the basis of the distribution of surrogate indicators, such as population or land use. The spatial allocation factor file developed for the NAPAP 1980 Emissions Inventory will be reviewed and updated to ensure that all counties or county equivalents are covered. It will be further verified that allocation factors cover all grid cells appropriately, that all area source SCC's are covered for each county/grid cell possibility, and that the allocation factors total 100 percent.

For certain land use types and county combinations, the surrogates will be zero (the land use type was not found within the county). An automatic default selection of population will be applied in these instances. Land use data used in the spatial allocation process is also being reviewed.

6.1.2 Temporal Allocation Factors

Temporal allocation factors are used by NAPAP to apportion annual emissions to hourly values for a typical weekday, Saturday, and Sunday within each session. The temporal allocation factor file provides these values on an SCC-specific basis. The factors for each SCC are specified individually for each "modeling day." The NAPAP QA/QC effort will involve summing the seasonal percents of each allocation factor set to ensure that they total 100 percent. Hourly fractions will also be summed and verified in this manner. In addition, each seasonal and diurnal pattern will be displayed graphically and viewed manually to ensure reasonableness. Each temporal allocation factor set will be checked to ensure that all "modeling days" are represented.

Part of the QA/QC effort will also focus on the Greenwich Mean Time and Daylight Savings Time Adjustment File. This file provides "offsets" to adjust local-time-specific temporal patterns to Greenwich Mean Time (GMT) and accounts for Daylight Savings Time, where applicable. This file will be examined to ensure that all counties and county-equivalents are accounted for and that the offsets are correct.

When processing point source emissions records, if no user-supplied temporal patterns are supplied, NAPAP will generate a point-source-specific pattern based on the operating rate data contained in the NEDS point source record. The algorithm used to generate patterns will be verified by comparing several manually processed records with those generated by the system. In addition, patterns generated by the algorithm for major emitters will be manually checked for appropriateness.

6.1.3 Species Allocation Factors

The VOC speciation factors used by NAPAP are generated by the Pollutant Splits Module (PSPLIT), a FORTRAN routine developed by EPA's Atmospheric Sciences Research Laboratory (ASRL). PSPLIT provides SCC-specific allocation factors for up to 30 VOC pollutant subspecies. To generate SCC-specific allocation factors, three files are input to PSPLIT, an SCC-index file, a VOC profile file, and a VOC class assignments file. The SCC-index file matches each SCC to the most appropriate profile. If data are available, State-, county-, plant-, and/or point-specific assignments can be made. Each profile in the VOC profiles file contains a breakdown of individual hydrocarbon species typical of the SCC. The class assignments file then assigns each hydrocarbon species to 1 of the 30 user-defined VOC classes, generally defined as a function of photochemical reactivity. QA/QC of the input files to PSPLIT will entail:

- extensive documentation of the development of the profiles, the assignment of the profiles to SCC's, and the assignment of the individual species to VOC classes (the VOC speciation input file documentation will be subjected to the NAPAP peer review process);

- ensuring that each SCC is assigned to a profile, and that the profile is appropriate (this will entail a manual engineering review);

- verifying that each pollutant species in the profile file is assigned to the appropriate VOC class in the class assignments file;

- verifying that the weight percents of the pollutant species in each profile total 100 percent; and

- conducting "desk checks" of the PSPLIT algorithms to verify the output data.

Allocation factors for other pollutants are manually coded; thus, different QA/QC procedures apply to them. Allocation factors assigning TSP to alkalinity and particle size classes will be subject to NAPAP peer review. Once computerized, these factor sets will be checked to ensure that they total 100 percent. Listings of the computerized files will be checked against the peer reviewed data to ensure that no transcription or coding errors occurred.

6.2 Guidelines for Data Processing

Development of the 1985 emissions inventory and its component data bases involves the development of several new software modules. Strict adherence to EPA's automated data processing QA/QC standards will be maintained in this development and testing effort. These standards require:

- use of accepted structured programming techniques;

- extensive documentation and verification of algorithms;

- desk checks of computer codes;

- test runs of all programs, verifying all paths of program execution;

- both internal and external documentation of program development, testing, and modification; and

- creation and maintenance of libraries of software and supporting documentation.

One of the most important groups of software modules that will be developed for the 1985 inventory effort must manage the NEDS "QA/QC loop." This loop includes the analysis of inventory data submitted by the States, the identification of questionable data, the establishment of an audit trail for the suspect data, and the documentation of how the questions have been resolved (i.e., with the verification of the original data, the substitution of new data, or the substitution of default values). The software must be able to print reports of data items flagged, establish and periodically update audit trails, and record all additions or corrections to any data element in the NAPAP data base.

7.0 CALCULATION OF DATA QUALITY INDICATORS

The principal data quality indicator that will be applied to the 1985 emissions inventory will be an uncertainty analysis. The analysis of uncertainty is important for several of the possible applications of the 1985 NAPAP inventory. It is particularly crucial for the atmospheric modeling effort which is aimed at establishing relationships between the release of precursor emissions and acid deposition. The degree of uncertainty in the emissions inventory will be a limiting factor in the quantification of these relationships.

Although the uncertainty analysis is somewhat separate from the inventory compilation and the QA/QC effort, some QA/QC of the uncertainty numbers is appropriate because of their importance to the inventory user community. Uncertainty of the emissions values will be calculated at all reporting levels possible. These include annual emissions totals as well as data fully resolved for modeling purposes. The following QA/QC measures will be employed to ensure the quality of the uncertainty estimates:

- o derivation of all statistical equations used in the uncertainty analysis will be documented and subject to the NAPAP peer review process;
- o software will be verified by manually calculating uncertainty for a number of cases and comparing results; and
- o the files containing uncertainty estimates for emission factors, sulfur/ash content, throughput, control efficiency, and allocation factors will be checked manually.

The uncertainty analysis should include information on completeness, representativeness, bias, coding errors, and confidence intervals.

8.0 PLANS FOR QA/QC REPORTS AND CORRECTIVE ACTION

As discussed in other sections of this report, QA/QC reports are planned for each of the intermediate data bases and inventories that are developed during the 1985 emissions inventory process. For particularly large data bases, such as the NEDS point source data base, periodic reports will be issued to track progress in resolving problems. These reports will identify suspect data and the corrective action that was taken to resolve the questionable data.

The workplan for the inventory (Table 7) identifies two significant meetings during the inventory development when participants will examine QA/QC reports and recommend corrective action. These occur in February 1987, after AEERL has documented problems with the State NEDS data, and in December 1987, after the NAPAP internal review panel has completed its review of the inventory.

9.0 REFERENCES

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